Port Louisa
National Wildlife Refuge
Keithsburg Division
Water and Sediment Quality

U.S. Fish and Wildlife Service
Summary Report
July 2012

Figure 1. An air boat was used for the field crew to collect water and sediment samples from interior shallow water wetlands at Keithsburg Division of Port Louisa National Wildlife Refuge.

Introduction

The Keithsburg Division of Port Louisa, National Wildlife Refuge is a backwater of the Upper Mississippi River. The ecological condition of the backwater is hyper-eutrophic with algal blooms, lush monotypic macrophyte production, and occasional game fish kills.

Goals and Methods

The U.S. Fish and Wildlife Service monitored water quality conditions at Keithsburg Division on May 12, 2012 and June 6, 2012, and on June 6, 2012 conducted an assessment of benthic macroinvertebrate diversity as a one day benthos blitz. The water samples were tested for ammonia-nitrogen, phosphorous-phosphates, and nitrate-nitorgen. The sediment samples were collected with an Ekman dredge and processed in the field. The sediment samples were washed through a standard mesh to enumerate the invertebrates.

Figure 2. Student workers wash sediment samples for invertebrates and then separate the invertebrates into different taxa for identification and counting.

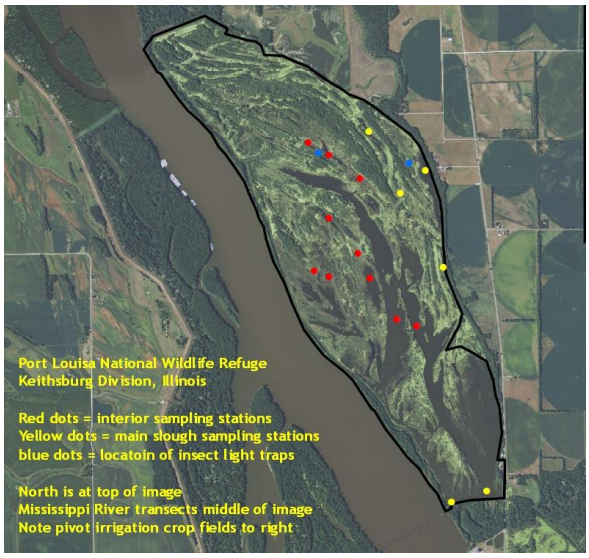

Figure 3. Map of Keithsburg Division showing sampling stations.

Results and Conclusions:

The nutrient chemistry data for the water samples were interpreted by arranging the samples along a gradient from the inputs of surface water and groundwater along the north and east boundaries to the outlet in the southwest corner of the backwater.

The surface water inputs along the ditches at the north end contained elevated ammonia (nondetected – 925 micrograms per liter), phosphates (106 – 211 micograms per liter), and nitrate (1.94 – 9.37 milligrams per liter). The concentrations were greater in the May sampling event compared to the June sampling event.

The groundwater inputs along the sandy bluff of the eastern boundary and the main

slough contained elevated phosphates (196 – 288 micrograms per liter). The interior surface waters contained elevated phosphates (160 – 286 micrograms per liter).

Nitrogen loading occurs at the north end of the Refuge unit from the ditches. The nitrogen loads were assimilated a short distance after flowing under the Refuge road tube. The elevated phosphates in the backwater system may be related to inputs, internal recycling from organic loading and release back into the water column. The available nutrients help fuel the eutrophic conditions.

The light traps did not attract any appreciable numbers of aquatic emergent insects. This may be due to the placement of the traps on the ground below the top of the floodplain vegetation. Swarms of aquatic insects may prefer the area above this vegetation layer.

A total of 16 sediment samples were processed including six samples from the main slough and 10 samples from the interior wetlands. The invertebrates were classified in the field to mostly to order and family taxonomic levels. Taxonomic richness was nine different groups including snails, mussels, fingernail clams, Asian clam, chironomids, oligochaetes, leeches, nematodes, amphipods, other midges, and other insect larvae or pupae. The modified Menhinick's Index (number of different taxa / number of organisms) for the main slough was 0.602 and 0.5417 for the interior wetlands. The dominant infaunal (substrate dwelling) invertebrates were chironomids at an average of 12.7 organisms per grab sample and oligochaetes at 2.7 organisms per grab.

These values were compared to a similar survey completed in 1995 with 21 sediment grab samples. The dominant infaunal organisms were oligachaetes at an average of 252.9 organisms per grab and chironomids at 3.9 organisms per grab. The lack of balance between chironomids and oligachaetes and the difference between the 1995 and 2012 data may be related to the fluxuating conditions in the sediment quality related to periods of massive organic loading from phytoplankton and macrophyte population crashes with senescence and the subsequent hostile environment related to the decay of the organic matter resulting in hypoxia and high hydrogen sulfide concentrations. Oligachaete abundance may increase with higher organic content in the sediments with favorable dissolved oxygen.

Figure 4. Chironomid or bloodworm (left & top) and oligachaete or aquatic worm (bottom right) specimens. These taxa can be the dominant biomass of benthic macroinvertebrates in nutrient rich shallow water wetlands and backwater sloughs.

Lessons Learned

- Keithsburg Division could benefit by reduced nutrient inputs and shallow water lake management such as drawdowns and dewatering to compact the sediments, dry out the organic matter, and allow emergent plants to use excess nutrients.
- Need to further explore the potential for nitrogen rich groundwater inputs along the eastern sandy bluff given the pivot irrigation farming in the floodplain.
- Future field surveys should include benthos sampling stations from the very north end of the Refuge.
- Future field surveys can better prepare for the invertebrate enumeration by hosting an identification workshop in advance of the field work. Create voucher specimens in alcohol.
- These data provide good baseline conditions to measure improvements in the ecosystem from resource management actions.